A NEW SPECIES OF *MERETRIX* FROM THE ARABIAN SEA (MOLLUSCA: BIVALVIA)

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Abstract *A new, economically important venerid species,* Meretrix marisarabicum *n. sp., from the estuaries of Karachi, Pakistan is described based on shell morphology and DNA phylogeny. This new species can be distinguished from other* Meretrix *species based on overall shell shape and the form of the pallial sinus; it has large, antero-posteriorly elongate oval shells with a very shallow pallial sinus. Although a number of shells of this species were also collected at archaeological sites in the Sultanate of Oman, where it was dated to Neolithic times between 5500 and 4000 BC, no live specimens have been found there. This absence is probably related to environmental changes of the Oman littoral during the Holocene Climate Optimum.*

Key words Meretrix, *new species, Arabian sea, COI*

INTRODUCTION

The bivalve genus *Meretrix* dates to the Upper Miocene and almost all recent species of the genus – there are 14 listed in Molluscabase (2020) – are restricted to the Eastern Indies (Keen, 1969). Hornell (1917) reviewed *Meretrix* present in the eastern Indian Ocean and Yoosukh & Matsukuma (2001) also reviewed four Thai species of *Meretrix* from coasts of the Indian Ocean side.

A comprehensive review of *Meretrix* shells stored in MNHN, Paris was done by Fisher-Piette & Fischer (1940–1941). Melvill & Standen (1907) recorded the following species of the subfamily *Meretricinae* from several locations of the Persian Gulf: *Tivela ponderosa* (Koch in Philippi, 1844) and *Meretrix zonaria* Lamarck, 1818 from Karachi; *Meretrix impudica* Chemn. var. *castanea* Lamarck, 1818 (var. *morphina* Lamarck, 1818), ranging from Bombay to Ratnagiri, Goa, and Panjim; *Meretrix petechialis* Lamarck, 1818 from Bombay. *Meretrix tumida* G. B. Sowerby III, 1895 from Karachi is enumerated by Melvill and Standen (1906). The species has well-inflated tumid shells and is originally placed in the subgenus *Meretrix* (*Caryatis*) Römer, 1862. However, it is not a species of *Meretrix* [Röding, 1798], but a species of *Pitar* (s.l.) Römer, 1857. Concerning Melvill & Standen's work, Fischer-Piette & Fischer (1940–1941) considered *M. impudica* var. *castanea* to be *M. castanea* (Lamarck, 1818), and *M. petechialis* and *M. zonaria* to be *M. meretrix* (Linnaeus, 1758).

More recent publications report the current distribution of genus *Meretrix* Lamarck, 1799 in the Persian Gulf, Oman Sea and North Indian Ocean but only one mention that *M. meretrix* exists for the Persian Gulf – in Abu Dhabi in the estuary of Khor al Bazm (Biggs, 1973). *Meretrix* is mainly distributed along the North Indian coast represented by the species *M. meretrix* (Linnaeus, 1758) and *M. casta* (Chemnitz) which are found in different estuaries in the south of Maharashtra (Mane & Nagabhushanam, 1988), Goa (Harkantra & Rodrigues, 2003) and Karnataka (Mane, 1980; Syda Rao *et al*., 1989; Syda Rao and Satyanarayana Rao, 1985).

In 1990, one of the authors (A. M.) found one articulated shell of an elongately oval *Meretrix* species (Fig. 1A–B) collected near Karachi, Pakistan, which was initially identified as *Meretrix lusoria* (Röding, 1798) at the U. S. National Museum of Natural History, Smithsonian Institutions, Washington, D. C. However, since convinced that this species is new to science, it was decided that it should be described after getting additional specimens to avoid a monotypic condition. In 2007 and 2008 a number of specimens of this *Meretrix* species were collected in Karachi by Mr. Hiroshi Nomi, Tokyo and sent to National

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Museum of Science and Nature, Tokyo (NMSN) for identification. In addition, Mr. Kenji Ishikawa, Tokyo also donated venerid shells from Karachi to the museum.

Between 2000 and 2004, several archaeological expeditions in the Sultanate of Oman were conducted by the French and Italian team directed by Profs M. Tosi (University of Bologna, Italy) and S. Cleuziou (University of Paris I, France). During the excavation of the Neolithic sites around Ra's al-Khabbah and as-Suwayh, a huge quantity of shells was discovered – the remains of a midden. Bivalves were favoured by the Neolithic people, particularly Veneridae, i.e. *Marcia marmorata* (Lamarck, 1818), *Marcia opima* (Gmelin, 1791) and *Amiantis umbonella* (Lamarck, 1818). As well as these three species, a great number of the new *Meretrix* species was found (Martin & Matsukuma 2006) in these archaeological sites of Oman (see results).

Although several investigators reported malacofauna of the Red Sea (*e.g*. Oliver, 1992) and Persian Gulf (Bosch *et al*., 1995), only one species of *Meretrix* has been recorded in the region by Biggs (1973) from Abu Dhabi – *Meretrix meretrix* (Linnaeus, 1758) [=*M. castanea* (Lamarck, 1818)].

In this study, based on shell morphology and molecular data, we describe a new species of *Meretrix* from the Arabian Sea and compare it with other congeners.

Institutional abbreviations:

NMSN: National Museum of Science and Nature, Tokyo.
USNM: United States National Museum of Natural History, Washington D.C.
MNHN: Museum National d'Histoire Naturelle, Paris.

Materials and Methods

Specimens studied in this work are mainly stored in NMSN (Table 1) and MNHN (Table 2). One paratype specimen is in USNM (Table 1).

Two specimens were subjected to molecular analysis. Total genomic DNA from each individual was extracted from 20mg of adductor muscle tissue using the Column Genomic DNA Isolation Kit (Beijing TIANGEN, China), eluted in elution buffer and stored at -20°C until use. The COI region was amplified by polymerase chain reaction (PCR) using the primers LCO1490 (forward: 5'-GGTCAACAAATCATAAAGATATTGG-3') and HCO2198 (reverse: 5'-TAAACTTCAGGG TGACCAAAAAATCA-3') (Folmer *et al*., 1994). PCR reactions were carried out in a total volume of 50 µL, including 2 µL DNA template, 1.5 mM $MgCl_2$, 0.2 mM of each dNTPs, 200 nM of both forward and reverse PCR primers, 1× buffer and 2.5 U Taq DNA polymerase. Thermal cycling was performed under the following conditions: 95°C for 3 min (initial denaturation), followed by 35 cycles of 95°C for 40s (denaturation), 48°C for 40s (annealing), 72°C for 40s (extension) and a final extension at 72°C for 5 min. Purified PCR products were sequenced in both directions using the BigDye Terminator Cycle Sequencing Kit (ver. 3.1, Applied Biosystems) and an AB PRISM 3730 (Applied Biosystems) automatic sequencer. Sequence alignments were generated using Clustal X (Larkin *et al*., 2007). For phylogenetic analyses, COI sequence from the present study and those from our unpublished data were used (see Table 3). *Cyclina sinensis* (COI: HM124568.1) was chosen as the outgroup. Neighbor-joining (NJ) tree was performed by MEGA 7.0.21 (Kumar *et al*., 2016), using Kimura 2-parameter (K2P) model (Kimura, 1980). Bootstrap analyses were performed with 1000 replications.

Table 1 Dimensions (in mm) for Holotype and paratypes of *Meretrix marisarabicum* n. sp. in NSMT and USNM.

	Valve	Shell Length	Shell Height	Convexity	Remarks
NSMT-Mo76796-1	R+L	61.28	42.27	27.02	Paratype 21
NSMT-Mo76796-2	R+L	57.28	40.92	26.82	Paratype 22
NSMT-Mo76797-1	R+L	69.75	50.09	33.97	Paratype 23
NSMT-Mo76797-2	R+L	76.39	56.48	38.64	Paratype 24
NSMT-Mo76797-3	R+L	62.80	48.10	32.07	Paratype 25
NSMT-Mo76801-1	R+L	77.19	55.87	17.89 (LV)	Holotype
NSMT-Mo76801-2	R+L	72.52	53.95	17.49 (LV)	Paratype 20
USNM 694005	R+L	69.5	-	-	Paratype 26

Table 2 Dimensions (in mm) of paratypes of *Meretrix marisarabicum* n. sp. in MNHN from the archaeological sites of the Sultanate of Oman.

	Valve	Shell length	Shell height	Convexity	Collecting site
Paratype 19	R+L	74.6	56.8	35.9	SWY**, Drill 11, Unit 7
Paratype 1	R	71.1	54.6	18.4*	SWY, Drill 11, Unit 7
Paratype 2	L	50.5	40.4	13.8*	SWY, Drill 1, Unit 15
Paratype 3	R+L	45.4	34.2	20.5	SWY, Drill 7, Unit 25
Paratype 4	R+L	44.0	34.1	22.0	SWY, Drill 7, Unit 25
Paratype 5	R+L	46.4	33.6	20.6	SWY, Drill 7, Unit 25
Paratype 6	L	58.0	44.5	15.9*	SWY, Drill 9, Unit 24
Paratype 7	R	50.0	38.0	13.6*	SWY, Drill 11, Unit 27
Paratype 8	R	21.4	15.2	5.1*	SWY, Drill 11, Unit 27
Paratype 9	L	22.5	17.2	5.8*	SWY, Drill 11, Unit 27
Paratype 10	R	18.6	14.4	5.1*	SWY, Drill 11, Unit 27
Paratype 11	R	16.9	12.2	4.2*	SWY, Drill 11, Unit 27
Paratype 12	R	17.0	12.2	4.2*	SWY, Drill 11, Unit 27
Paratype 13	L	15.4	11.7	3.8*	SWY, Drill 11, Unit 27
Paratype 14	L	13.7	10.0	3.1*	SWY, Drill 11, Unit 27
Paratype 15	R	47.2	34.1	11.5*	SWY, Drill 11, Unit 43
Paratype 16	R	37.7	27.7	9.6*	SWY, Drill 11, Unit 43
Paratype 17	L	37.5	27.9	10.6*	SWY, Drill 11, Unit 43
Paratype 18	L	36.7	27.6	9.7*	SWY, Drill 11, Unit 43

*: Convexity of single valve.
**. SWY is the abbreviation of As-Suwayh

Table 3 List of species from which the COI sequences derived.

Species	Collection locality	Accession number
Meretrix marisarabicum n. sp.	Karachi, Pakistan	MF893201
M. lamarckii in Japan	Kujukuri, Chiba, Japan	KX534224
M. lamarckii in China	Xinliao, Zhanjiang, China	KX534227
M. lusoria	Imari, Saga, Japan	KX534241
M. lyrata	Beihai, China	KX534242
M. meretrix	Beihai, China	KX534252
M. petechialis southern lineage	Beihai, China	KX534265
M. petechialis northern lineage	Ganyu, China	KX534273
M. planisulcata	Qinzhou, China	KX534316

Result and Systematic Descriptions

Superfamily Tellinoidea Blainville, 1814

Family Veneridae Rafinesque, 1815

Genus Meretrix Lamarck, 1799

Types species: *Venus meretrix* Linnaeus, 1758 (by absolute tautonomy); Indian Ocean.

Diagnosis Shell medium to large, thick, solid, subtrigonal to ovate, strongly inequilateral, equivalve. Outer surface smooth, occasionally with regularly spaced commarginal ribs. Periostracum not hairy, but filmy. Right valve with three cardinal teeth (1, 3a and 3b) and two anterior lateral teeth (LAI, LAIII); left valve with three cardinal teeth (2a, 2b and 4) and an anterior lateral tooth (AII); dorsal side of 4 and ventral side of right valve nymph finely crenulated. Ligament parivincular, opisthodetic. Adductor muscles heteromyarian, anterior adductor muscle scar smaller than posterior scar. Pallial line entire; pallial sinus shallow to very shallow. Inner ventral margin smooth.

Meretrix marisarabicum Martin & Matsukuma new species
(Figs 1–3)

Holotype NMSN, reg. no. NSMT-Mo76801-1, 1 animal, Karachi, Pakistan, collected by Hiroshi Nomi, on May 29, 2008.

Paratypes NMSN, reg. no. NSMT-Mo76801-2, 1 animal, collected with the holotype. NMSN, reg. no. NSMT-Mo76796, 2 conjoined shell specimens, Korangi Creek, collected by Hiroshi Nomi and Zahir Shah, on May-July, 2007. NMSN, reg. no. NSMT-Mo76797, 3 conjoined shell specimens, estuary on the river mouth of a branch of the Indus, about 33km from Karachi, collected by Hiroshi Nomi, on May 19, 2008. USNM, reg. no. 694005, 1 conjoined shell specimen, Karachi, Pakistan, collected by El Husseini. MNHN-Paris, 19 *Meretrix* shells from archaeological sites at As-Suwayh near Bani Bu Ali, Sultanate of Oman.

Type locality Estuaries in Korangi Creek, c.a. 33km east southeast (ESE) of Karachi, Pakistan.

Etymology Mare Arabicum, the Arabian Sea.

Measurements see Tables 1 and 2.

Description Shell moderately large, up to 76mm in length, antero-posteriorly elongate subtrigonal, thick, inequilateral, equivalve. Beak prosogyrous, moderately high, placed slightly anterior to midpoint of dorsal margin. Anterior margin thick, more or less narrowly rounded; ventral margin widely rounded, with dull sinuation before postero-dorsal corner; posterior margin narrow, obliquely truncated, with bluntly pointed postero-ventral corner; postero-dorsal margin long, gently arched or substraight. Lunule weakly defined; no small pit at the commissure plane below lunule. Escutcheon very nearly defined.

Outer surface glossy, smooth, without irregularly spaced growth lines and wrinkles at anterior area just behind lunule. Outer coloration light brown, purplish brown to white, occasionally with irregularly spaced narrow radial streaks; inner coloration white; posterior adductor scar tinged with purple; anterior adductor scar occasionally partially tinged with dark purple. Hinge plate short, thick, gently arched, with weak AI, AIII, and three cardinal teeth (1, 3a, 3b) in the right valve; strong AII, three cardinal teeth (2, 4a, 4b) in the left valve; Ventral side of nymph and dorsal side of 4b finely serrate.

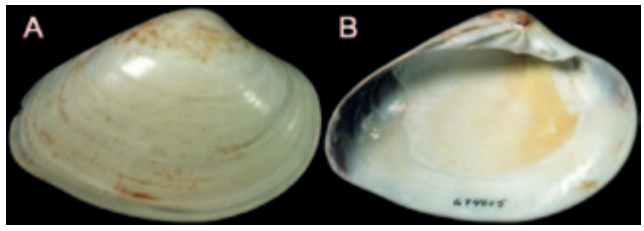

Figure 1A–B *Meretrix marisarabicum* n. sp., USNM694005, paratype, SL 69.5mm.

Pallial line distinct; area between pallial line and shell margin wide. Pallial sinus very shallow, without heel. Anterior adductor scar semilunar, smaller than oval posterior adductor scar.

Distribution The distribution of *Meretrix marisarabicum* n. sp. seems to be restricted to the Pakistan coast around Karachi. Great numbers of animals are collected at estuaries in Korangi Creek, ca. 33km ESE of Karachi by local fishermen (Fig. 4); Ormara, Gwadar District, about 360km west of Karachi and the Makran coast region, Balochistan, southwest Pakistan.

Archaeological settings Meretrix marisarabicum seems to be restricted to the Arabian Sea. Except for the specimen stored in U. S. National Museum of Natural History, Smithsonian Institutions, Washington, D. C. and animals exported to Tsukiji Fishery Market, Tokyo from Karachi, all the *M. marisarabicum* n. sp. were subfossil and from archaeological excavations (Table 2) approximately 6000 to 3000 BC, but also from geological drills (Table 4), made around the site of the Neolithic human occupation. These archaeological sites are mainly composed of fish and shell remains resulting from human consumption (Martin, 2005). Occasionally the valves of Veneridae are used as knives tools for crushing, scraping and cutting (Charpentier, 2004).

Ecological information The current environment of As-Suwayh, just behind the site, is composed of sand dune and sebkha. This sebkha reveals the presence of a lagoon during the archaeological occupation. To understand the lagoon's evolution, several geological drills were made (Table 5). They show some modifications of the environment during the Optimum Holocene with

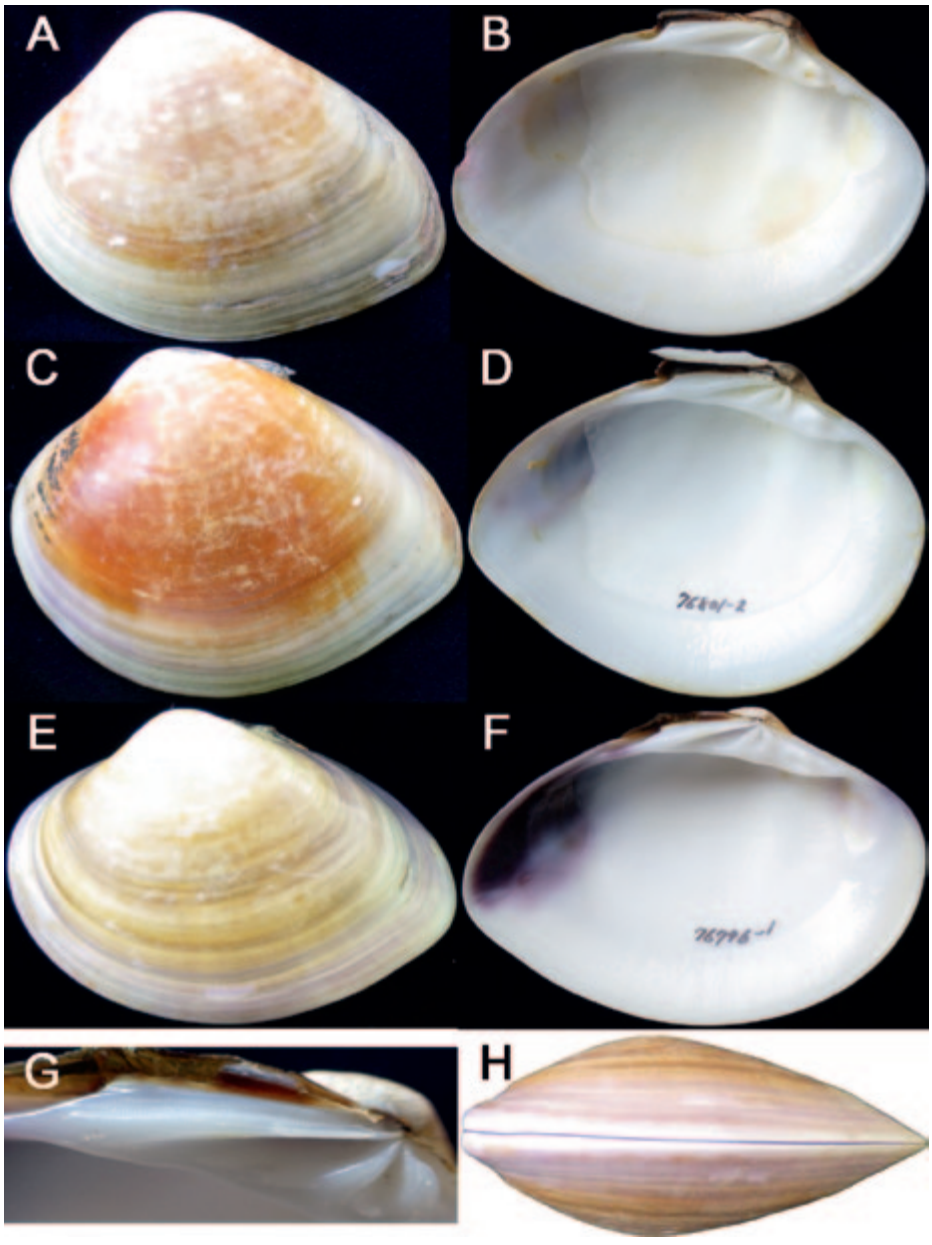

Figure 2A–H Type material of *Meretrix marisarabicum* n. sp. from Karachi, Pakistan. **A–B** NSMT-Mo76801-1, holotype, SL 77.19mm. **C–D** NSMT-Mo76801-2, paratype 20, SL 72.52mm. **E–F** NSMT-Mo76796-1, paratype 21, SL 61.28mm. **G** Crenulations of ventral side of nymph and dorsal side of posterior cardinal in the left valve, NSMT-Mo76796-1. **H:** Ventral view of *Meretrix marisarabicum* n. sp., NSMT-Mo76797-1, paratype. SL 69.75mm. Note thickened anterior margin.

the appearance of a mangrove around 5000 BC, with characteristic mollusc assemblages composed mainly of *Terebralia palustris* (Linnaeus, 1767), *Littoraria intermedia* (Philippi, 1846) and *Saccostrea cucculata* (Born, 1778). All these environmental modifications can explain the absence of *Meretrix marearabicum* n. sp. along the Oman coast today.

Remarks One of forms of *Meretrix lusoria* (Röding, 1798) of the northwestern Pacific has anteroposteriorly elongated shells like *M. marisarabicum* n. sp. To describe the species Röding (1798) referred to Chemnitz (1682, pl. 32, fig. 340). Chemnitz's illustrated specimen is a probable syntype and is stored in the Zoological Museum, University of Copenhagen (Cernohorsky, 1974,

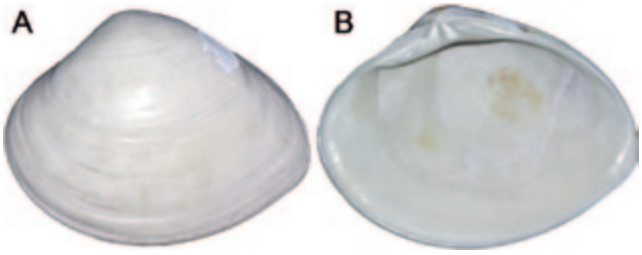

Figure 3A–B *Meretrix marisarabicum* n. sp., NHNH, paratype 16 from the archaeological site of as-Wayh, the Sultanate of Oman, SL 74.6mm.

Figure 4 Estuary in Korangi Creek, ESE of Karachi, Pakistan. Photo by H. Nomi.

Table 4 *Meretrix marisarabicum* n. sp. from the geological drills.

	Unit	Right valve	Left valve	^{14}C (calibration 2σ)*
Drill 1	15		3	
Drill 11	7	4	2	
Drill 11	18	1		
Drill 11	26		1	
Drill 11	27	18	24	
Drill 11	43	10	12	403–208 BC cal
Drill 4	22	3	1	3679–3499 BC cal
Drill 7	25	5	6	
Drill 7	23C	2	2	3358–2774 BC cal
Drill 9	23	2		
Drill 9	24	4	3	4354–3938 BC cal
Total		49	54	

*, ^{14}C made on shells with measurements of the marine reservoir effect in the Arabian Sea (Saliège *et al*. 2005).

fig. 67; Habe, 1978: 36, fig.). *Meretrix formosa* G. B. Sowerby II (1851, p. 620, pl. 129, fig. 47) is a junior synonym of *Meretrix lusoria* (Röding, 1798) (Deshayes, 1853; Römer, 1865; Habe, 1981). *Meretrix marisarabicum* n. sp. differs from *M. lusoria* by possession of the deeper pallial sinus and a weak sinuation of ventral margin just before postero-ventral corner.

Table 5 Distribution of *Meretrix marisarabicum* n. sp. in the archaeological sites of the Sultanate of Oman. The specimens come mainly from the sites around as-Suwayh village.

Archaeological sites	Right valve	Left valve	Date (roughly)
Ra's al-Khabbah 1	22	56	4000–3000 BC
Suwayh 1	385	812	5500–4000 BC
Suwayh 3	966	919	2300–2000 BC
	1373	1787	

A revision of the Indian species of *Meretrix* done by Hornell (1917) includes the following 3 species and several varieties from the Indian Ocean: *Meretrix meretrix* (Linnaeus, 1758), *M. casta* (Gmelin, 1791) and *M. attenuata* Dunker, 1863. Although type material of *Venus meretrix* Linnaeus, 1758 is not found at the Linnean Collection of the Linnean Society of London, the Museum of Evolution, Uppsala University stores 4 lots of supposed type material with a label of *Meretrix meretrix*, i.e. UUZM #424, 1363, 1376, and 1377 (Wallin, 2001). By courtesy of Dr. Erica Mejlon (Museum of Evolution, Uppsala University), we examined photos of the supposed syntypes. The two specimens, i.e. #1363 and 1376, have inscriptions of "jap" and "Hamagui" on the inner or outer shell surface. "Hamagui" is an error for "hamaguri", which is Japanese vernacular name of *Meretrix lusoria* (Röding, 1798). The three specimens, i.e. #1363, 1376 and 1377, have trigonooval shells with a very shallow pallial sinus and are identical with *M. lusoria*. The specimen #424 has a subtrigonal shell with a deeper pallial sinus. This is possibly identical with *Meretrix lamarckii* Deshayes, 1853 (supposed syntype BMNH reg. no. 20000390) or *M. subtrigona* (Dunker, 1857). *Meretrix meretrix* (Linnaeus) sensu Hornell (1917, pl. 5, fig. 13) with a subtrigonal shell is identical with *M. meretrix* authors (Gmelin, 1791: 3273; Reeve, 1864: *Meretrix* pl. 3, sp. 10; Römer, 1865: 27–29, pl. 8, fig. 1; Zhuang, 1964: 74–75, pl. 4, fig. 3; Yoosukh & Matsukuma, 2001, pl. 1, figs. 1–7; Xu & Zhang, 2008: 248–249, fig. 792; Huber, 2010: 389, figs.). *Meretrx marisarabicum* n. sp. differs from *Meretrix meretrix* authors by possession

of antero-posteriorly elongated oval shell with a weak sinuation before postero-ventral corner.

Gmelin, (1791) proposed *Venus casta* and refered to Chemnitz (1782, p. 349, pl. 33, fig. 346). *Meretrix casta* is considered to be a species with heavy hinge and short cordate to more or less elongate shell. Hornell (1917) considered *Cytherea ovum* Hanley, 1844 (neotype, BMNH reg. no. 1912.6.18.13, from Malabar, India) as a variation of *M. casta*. *Cytherea ovum* has an oval shell with rounded anterior and posterior margins and lacks a postero-ventral sinuation. *Meretrx marisarabicum* n. sp. differs from *Meretrix casta* by possession of antero-posteriorly elongated oval shell with a weak sinus before postero-ventral corner.

According to Dunker (1863, pp. 53–54, pl. 17, figs. 7–9), *Meretrix attenuata* Dunker, 1863 has trigonal shells with a straight postero-dorsal margin, a high and pointed umbo and a deep pallial sinus. *Meretrx marisarabicum* n. sp. differs from *Meretrix attenuata* Dunker, 1863 by possession of antero-posteriorly elongated oval shell with a weak sinus before postero-ventral corner.

Although antero-posteriorly elongated shells with thickened antero-ventral shell margin and no or weakly developed streaks on the shell surface are common to *Meretrix marisarabicum* n. sp. and *M. castanea* (Lamarck, 1818), this new species differs from *M. castanea* by possession of a shallower pallial sinus (Figs 1B, 2B, 2D, 2F, 3B) and lacking dark brown dots, bars, or zigzags on the outer shell surface.

Molecular Analysis

We successfully amplified COI sequences from the holotype (NSMT-Mo76801-1) and one individual of the paratypes (NSMT-Mo76801-2). However, they share one haplotype which has been deposited in GenBank (Accession number: MF893201). The length of the COI sequence is 658 bp. The Neighbor-joining (NJ) tree (Fig. 5) was reconstructed using COI sequences from *Meretrix marisarabicum* n. sp. and *Meretrix* species collected from China and Japan. The alignment of COI had a total 632 bp. Phylogenetic analysis of the COI gene clearly shows the new species falls into the genus *Meretrix* and differentiates with all other species. In addition, the K2P genetic distances between the *M. marisarabicum* n. sp. and other *Meretrix* species were 16.6% to 20.8% (Table 6), with the congeneric distance range of the venerids (5.45%-34.17%, Chen *et al*., 2011). In addition, considering the mean conspecific variation of the venerids (0.49%, Chen *et al*., 2011), the distance between *M. marisarabicum* n. sp. and other *Meretrix* species is sufficient to warrant the separation of *M. marisarabicum* n. sp. Thus, both

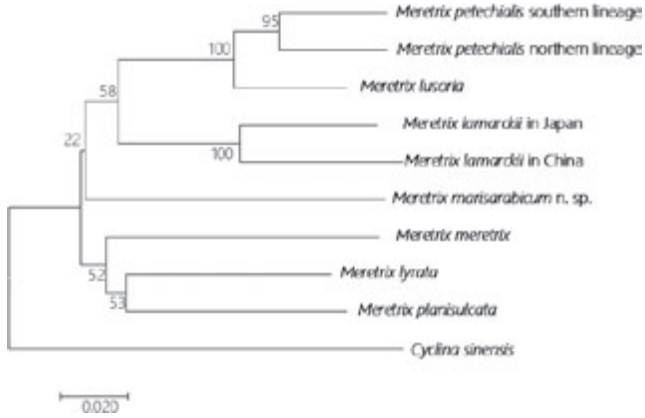

Figure 5 Neighbour-joining tree for *Meretrix* species based on COI sequences. Numbers aside branches indicate the bootstrap values.

Table 6 Pairwise distances among *Meretrix* species based on Kimura 2-parameter model. Standard error estimates are shown above the diagonal.

	1	2	3	4	5	6	7	8	9
Meretrix marisarabicum n. sp.		0.019	0.018	0.019	0.017	0.019	0.021	0.019	0.017
M. lamarckii in Japan	0.177		0.012	0.016	0.018	0.019	0.018	0.018	0.018
M. lamarckii in China	0.168	0.094		0.018	0.017	0.020	0.018	0.018	0.019
M. lusoria	0.185	0.136	0.170		0.016	0.018	0.013	0.012	0.017
M. lyrata	0.172	0.174	0.164	0.161		0.017	0.016	0.016	0.015
M. meretrix	0.188	0.179	0.191	0.165	0.157		0.018	0.019	0.017
M. petechialis southern lineage	0.208	0.160	0.166	0.089	0.161	0.180		0.011	0.017
M. petechialis northern lineage	0.183	0.168	0.173	0.080	0.165	0.195	0.069		0.017
M. planisulcata	0.166	0.177	0.189	0.163	0.131	0.153	0.167	0.171	

the phylogenetic and distance analysis provides ample justification for recognizing *M. marisarabicum* n. sp. as a distinct species.

Discussion

Meretrx marisarabicum n. sp. differs morphologically from any *Meretrix* species reported from the Indo-Pacific regions by possession of more elongated shells and a weak sinus before postero-ventral corner. This together with the phylogenetic and distance analysis data provide confirmation that *M. marisarabicum* n. sp. is a species distinct from other species within the genus *Meretrix*.

It is interesting that living specimens of *Meretrix marisarabicum* n. sp. are absent on the North Oman coast in samples prospected during several expeditions between 2002 and 2004 and no specimens of *Meretrix* were found, except for fossil specimens on archaeological sites. This absence is probably related to the environmental modification of the Oman littoral during the Optimum Holocene. In fact, the archaeomalacological material appears a precious benchmark for the study of this species apparently restricted today in the region of Karachi.

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